TITLE: **NOVEL CORROSION SENSOR FOR ADVANCED ENERGY SYSTEMS**

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ABSTRACT

Objectives

The overall goal of this project is to develop a technology for on-line corrosion monitoring based on an innovative concept. The specific objectives and corresponding tasks are to: (1) develop the sensor and electronic measurement system; (2) evaluate and improve the system in a laboratory muffle furnace; and (3) evaluate and improve the system through tests conducted in a pilot-scale coal combustor.

Accomplishments to Date

The task for the first year is to develop the sensor and electronic measurement system. This task has been successfully completed. The probe and the measurement system are developed in the laboratory. The task for the second year is to test the system in a muffle furnace, which is also successfully completed. The completed work included the re-design and building of a probe that can accommodate the ceramic connectors, which are more durable for elevated temperatures. The probe temperature measurement and control were tested in the laboratory and also tested at a power plant environment. In addition, a second probe temperature control system is available, which were used in power plant environment for other probes. The new controller is more portable and rugged, which is better for location changes and the dusty and elevated temperature

environment in a power plant. The probe temperature, or the temperature of the sensing element, is controlled with compressed air cooing. The electronic measurement with computer data acquisition performed well in the laboratory for automatic measurement and data storage for weeks without the need for operator intervention.

A new sandwich-type sensor was developed and tested in a coal-fired power plant. Through the interactions with plant operators and visits to power plants, the sensor and probe were re-designed and fabricated based on the information and practical constraints during the operation of the system in a plant environment. In the original plan, the probe system was to be tested at a pilot combustor. The experiences at the pilot coal combustor and the power plant indicated that, the power plant testing was easier to achieve our goal than testing at the pilot coal combustor. The main reason was that the operating condition of the pilot combustor was only held constant for a few hours as the corrosion test was piggyback with other combustion or emissions tests. The corrosion measurement typically requires a couple days to produce statistically meaningful data. Therefore, we decided to focus the testing at the power plant instead of the pilot coal combustor.

Currently, the probe was tested at a power plant that had varying load. The results showed that the new sensor and measurement system were able to determine the corrosion rate for the boiler tubes. We are in a process to obtain access to a base-load plant for longer-term testing to produce metrology data to verify the probe measurement results.

Future Work

(1) Test the system at a coal-fired power plant to further demonstrate that (a) the system can measure fireside corrosion, (b) the results can be confirmed by direct metal-loss measurements, and (c) the system is rugged enough for long-term the plant environment.

List of Paper Published

Li, Z.P., Lin, B.C., and Ban, H., A Novel Sensor for Fireside Corrosion Monitoring, The Proceedings of the 20th Annual International Pittsburgh Coal Conference, 2004.

B. Lin and H. Ban, Measurement of Waterwall and Superheater Corrosion, Southeastern Electric Exchange Annual Conference, Orlando, FL, June 28-30, 2006

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